7. $x = t^3 - 3t^2$ at rest

$y = 2t^3 - 3t^2 - 12t$

speed $= \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2} = 0$

if $\frac{dx}{dt} = 0$ and $\frac{dy}{dt} = 0$

$\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$

$\frac{dx}{dt} = 3t^2 - 6t = 0$

$3t(t-2) = 0$

$t = 0$ or $t = 2$

$\boxed{t = 2}$

$\frac{dy}{dt} = 0 = 6t^2 - 6t - 12$

$= 6(t^2 - t - 2)$

$= 6(t+1)(t-2)$

$t = 2, \; t = -1$

distance = arc length = length of a curve $= \int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$

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15. $x = 1 \quad x = 4$

$\int_1^4 \sqrt{1 + 9x^4}\, dx$

$\int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$

$(1, 6)$

$\frac{dy}{dx} = 3x^2$

$\boxed{y = x^3 + 5}$

$y = x^3 + C$

$6 = 1^3 + C$

$5 = C$

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17. $x = t^2 - 4t + 1$, $y = t^3$, $8 = t^3$, $t = 2$ tan at $(-3, 8)$

$$\text{slope} = \frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{3t^2}{2t-4}\Big|_{t=2} = *$$

$\boxed{x = -3}$

vertical line

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18. $g(x) = \int_0^{2x} f(t)\,dt$

$g'(3) = ?$ $f(6) \cdot 2 = -1 \cdot 2 = \boxed{-2}$

$g'(x) = f(2x) \cdot 2$

$$\frac{d}{dx}\int_a^{g(x)} f(t)\,dt = f(x)$$

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20. $\frac{x^4}{2!} + \frac{x^5}{3!} + \frac{x^6}{4!} + \cdots + \frac{x^{n+3}}{(n+1)!}$

$e^{x^2} - x^2 - 1$

a) $e^x = 1 + x + \frac{x^2}{2} + \frac{x^3}{3!} \cdots$

$e^{x^2} = 1 + x^2 + \frac{x^4}{2} + \frac{x^6}{3!} \cdots$

b) $x^2 e^x - x^3 - x^2$

$x^2 + x^3 + \frac{x^4}{2} + \frac{x^5}{3!} \cdots$

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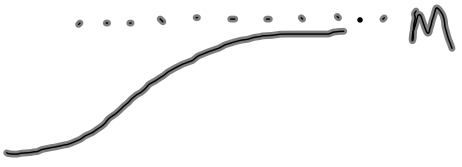
21. $\frac{dm}{dt} = .6\, m\left(1 - \frac{m}{200}\right)$ carrying capacity $m(0) = 50$

$= .6 \cdot \frac{1}{200} m \cdot 200\left(1 - \frac{m}{200}\right) = \frac{.6}{200} m(200 - m)$

$\lim_{t \to \infty} m(t) = ?$, 200

$\frac{dP}{dt} = kP(M - P)$

carrying capacity



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22 $\sum \frac{n}{n^p+1}$ $\leq \frac{n}{n^p} =$

$\leq \frac{1}{n^{p-1}}$

$p-1 > 1$

$p > 2$

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24. $r = \frac{\sin 2}{\pi}$

$\sum_{n=0}^{\infty} \left(\frac{\sin 2}{\pi}\right)^n$ geo $r<1$ conv.

$\sum_{n=1}^{\infty} \frac{1}{\sqrt[3]{n}} = \frac{1}{n^{1/3}}$ p series $p<1$ div

$\sum_{n=1}^{\infty} \frac{e^n}{e^n+1}$ seq $\to 1$

series div

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